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FOCUS

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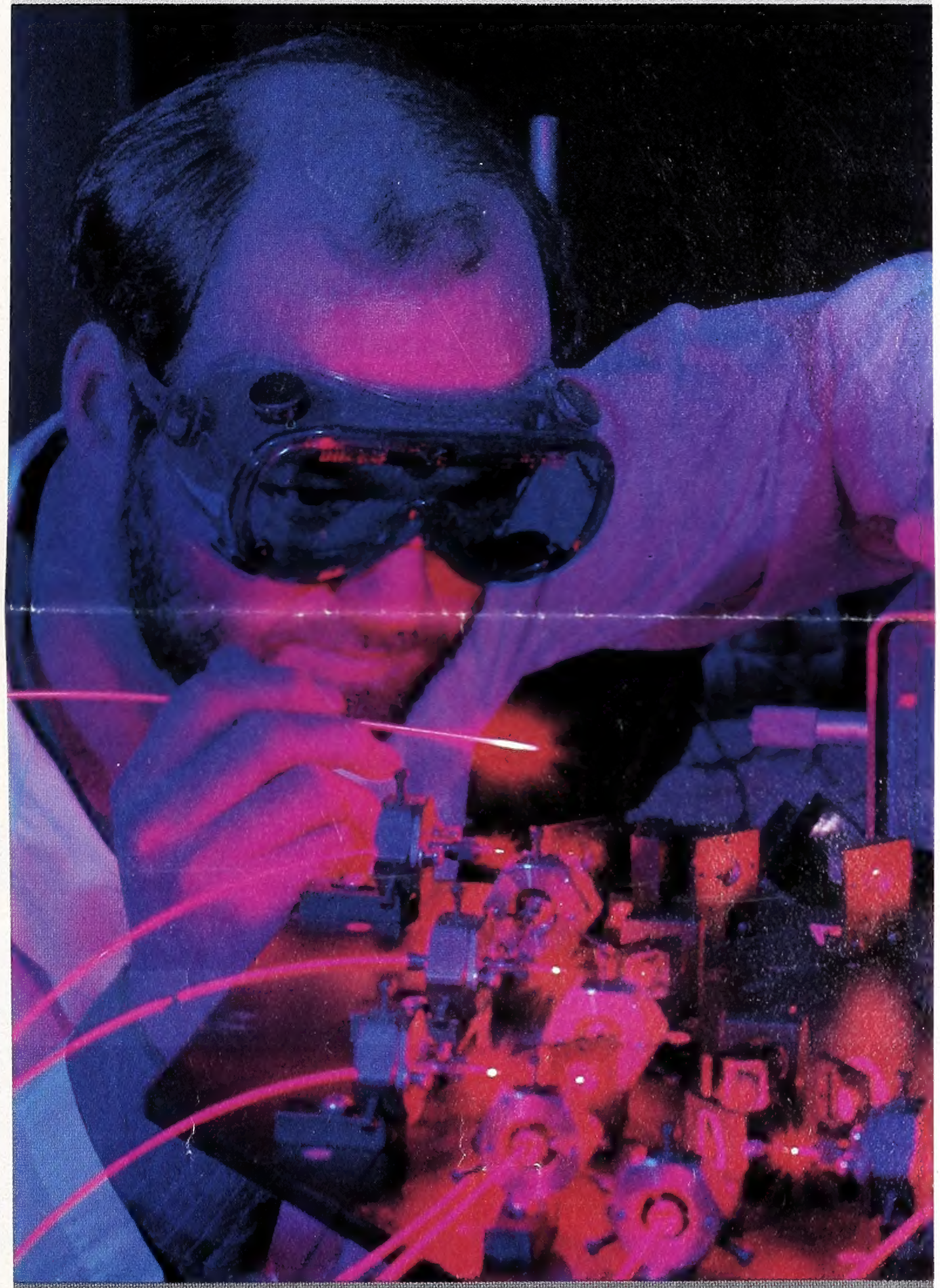

FOCUS ON

LASERS

The Light Fantastic

"Alberta has some very bright technology people who have generated an enormous amount of laser technology background over the years. And all of that is now coming to fruition."

In a three-decade journey from science fiction to reality, laser technology has made impressive strides in revolutionizing everything from surgical procedures to industrial processing, creating a global market for commercial lasers which will top $600 million in 1988.

In North America alone, the market by the mid-1980s stood at more than $300 million and the industry was gearing up for 25 per cent annual growth for the balance of the decade, fuelled in part by accelerating demand for lasers in microelectronics manufacturing equipment.

The use of lasers — as surgical tools, as sensing instruments such as those that read bar codes at the supermarket counter, in manufacturing and materials processing, research, communications, entertainment, crime detection, the printing and graphics industry, in virtually every facet of North American life — suggests a technological revolution of mammoth proportions is well under way.

The term "laser" — acronym for Light Amplification by Stimulated Emission of Radiation — is still associated in many minds with "zap, bang" antics of ray-gun toting heroes and villains of futuristic comic strips. However, industry observers predict such images will fade as society becomes more familiar with the benefits of laser light in enhanced medical and dental procedures and in higher quality consumer products.

Created by exciting gases, crystals or liquid dyes with an energy charge, lasers emerge as tightly focused or "coherent" light beams with the power to zero in on a minute target. Their value lies in their ability to perform highly intricate welding, cutting and vaporizing tasks on materials ranging from human tissues to metals, plastics and wood.

If Albertans are slightly more at home with the technology than some Canadians, there's good reason. They've been hearing first-hand accounts for many years of research involving the "magic beams" of argon-driven dye lasers, carbon dioxide lasers and those using yttrium-aluminum-garnet or YAG crystals. And if the province's tightknit community of laser experts has its way, there will be many more Alberta-born advances in laser technology and application in the future.

Since the mid-1960s, when researchers in the University of Alberta's electrical engineering department turned their attention to the potential of the new laser technology, Alberta has been an acknowledged Canadian leader in exploring and promoting the use of lasers.

For example, a laser-based surgical tool, one of a series of breakthroughs in the medical laser field spearheaded by the department's Dr. John Tulip, is now being readied for market by Edmonton-based Aurora Laser Inc. Elsewhere in the department research continues on inertial confinement fusion as a potential energy source.

As a direct result of the U of A's pioneering work in lasers, the Alberta LASER Institute was established in 1985. A five-year funding program saw the provincial government contribute $5 million and the federal government $1.5 million. Along with contract fees now being generated by the facility from its work with industry, this has enabled the agency to encourage Alberta firms to take advantage of Alberta's lead in the field by using lasers in everything from automated manufacturing and materials processing to medical applications and microelectronic chip fabrication.

In 1987, the Institute opened a materials processing facility. By offering contract laser services and expertise, it opens the door for Alberta entrepreneurs to test the technical and economic feasibility of potential industrial laser applications — before making sizable investments in their own equipment.

Dale Allsopp, program director of optics and robotics at the Institute, explains, "Alberta has some very bright technology people who have generated an enormous amount of laser technology background over the years. And all of that is now coming to fruition."

Institute Chairman John Long stresses the importance of technology transfer and notes that Alberta companies are likely to "benefit the most" from resources and expertise available through the University and Alberta LASER Institute.

The private sector, too, has done its share of pioneering in the field. General Systems Research Inc. (GSR), an Edmonton-based high technology firm with more than 100 employees, established an early international lead in the design, development and production of auto-

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LASER Institute adds new dimension to industry

When executives of Calgary's Palco Telecom Inc., a company which refurbishes used telephone equipment, needed square holes in some 350 old telephone housings to accommodate a master switch, they considered buying a conventional tool for punching out the openings. In the end, however, they chose to try new technology — laser cutting provided by the Alberta LASER Institute.

The Alberta LASER Institute helps Alberta industries incorporate laser technology into their own operations.

Campbell Kelly, Palco manager of technical support, said that while the company expected to end up with a better product, they weren't prepared for the economics of the deal. "To our surprise, it turned out to be more cost effective for us to have them do the job with their small carbon dioxide laser than to do it ourselves using conventional technology."

As a bonus, he adds, use of a laser meant there were no stress marks left on the housing.

As a result of this single contact, Palco, like many other Alberta firms, has become an unofficial promoter of a new industry resource, which in Kelly's words, "has the capability to carry out intricate functions on fragile materials — and do them cost effectively".

This is precisely the result the Alberta LASER Institute hopes to achieve through its contacts with industry. Its mandate is to both educate Alberta industries to the advantages of laser technology in automated manufacturing, materials processing, medical applications and microelectronic chip fabrication and help them explore the potential of incorporating lasers into their own operations.

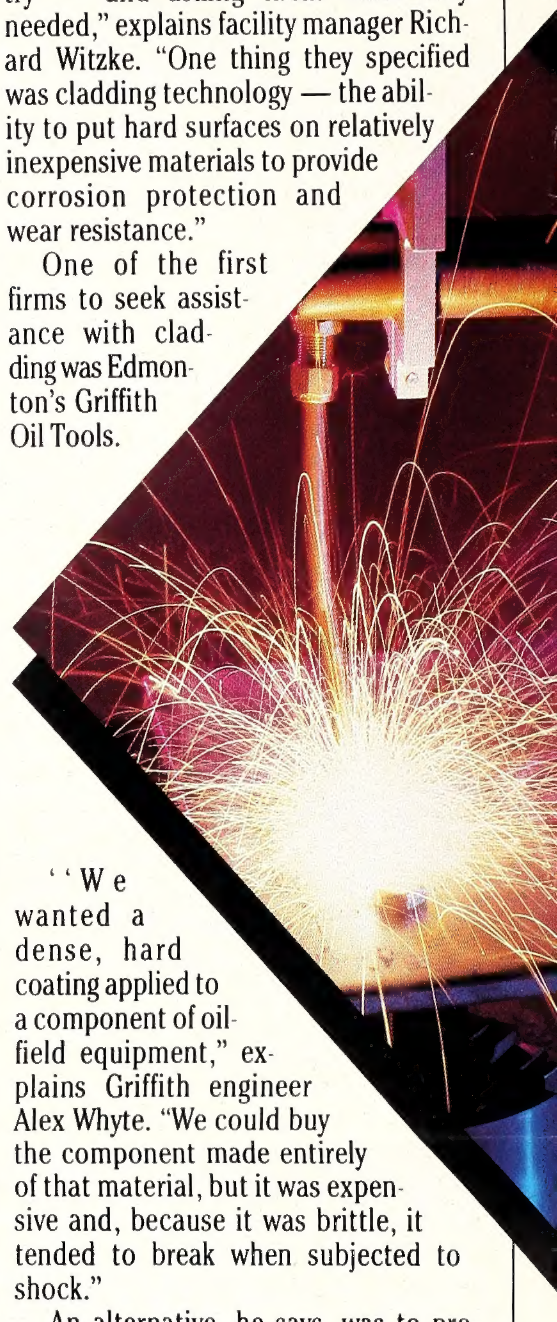
Established in 1985, the Institute became more visible last year with the official unveiling of its materials processing facility. Equipment includes a CE-5000 Five Kilowatt CO_2 laser and a CE-1000 Eight Kilowatt CO_2 laser and capabilities include cutting, heat treating, cladding, welding and drilling of materials ranging from ceramics, plastics, rubbers and glass to wood, textiles, paper and electronic circuit fabrication elements.

In addition to materials processing and prototype development, the centre offers expertise in laser sensors and electronics and medical applications.

As part of the Electronics Network of Alberta, an association of Alberta high technology centres dedicated to encouraging growth of the province's electronics industry, the Alberta LASER Institute can draw on a broad range of advanced technology contacts in counselling its industry clients.

"We started out by going to the oil and gas sector as Alberta's major industry — and asking them what they needed," explains facility manager Richard Witzke. "One thing they specified was cladding technology — the ability to put hard surfaces on relatively inexpensive materials to provide corrosion protection and wear resistance."

One of the first firms to seek assistance with cladding was Edmonton's Griffith Oil Tools.



"We wanted a dense, hard coating applied to a component of oil-field equipment," explains Griffith engineer Alex Whyte. "We could buy the component made entirely of that material, but it was expensive and, because it was brittle, it tended to break when subjected to shock."

An alternative, he says, was to pro-

Edmonton laser engraver captures Olympic spirit

The cross-Canada Olympic torch relay, followed on millions of Canadian television sets earlier this year, may have appeared to most viewers to be the journey of a single beacon. But Ed Korbyl, owner of Edmonton's Columbia Trophy and Engraving, is only too aware that dozens of torches were involved.

The first engraving firm in Western Canada to install a laser engraving machine, Korbyl's company was chosen by relay sponsors Petro-Canada to produce finely detailed drawings depicting the various Olympic sports on the wooden handles of all 150 torches prepared for the relay.

Despite the impressive capabilities of the company's Apollo carbon dioxide laser, purchased in 1986 for about $150,000, Korbyl admits to some "sleepless nights" while he and others on the nine-member staff struggled to match technology to the task at hand. In a sense, the challenge was simple, he recalls. "Nothing less than perfection would do."

Since the equipment was not specifically designed to engrave circular objects, special care had to be taken to prepare and set the jigs that guided the whole operation. Once the first handle was completed to the engravers' satisfaction, however, the rest of the job went smoothly and the handles were delivered to Calgary.

"I was later told that each symbol on all 150 handles was carefully inspected to ensure it was perfect — and they all passed the test."

The laser installation has garnered valuable publicity for the company and attracted new customers from across the west and even the United States.

Korbyl rates quality rather than speed as the major advantage of the equipment. His choice of unit was made following months of research, which included seeking guidance from the Alberta LASER Institute. "We were the very first people to go to them to ask about laser applications in business."

The unit can be used to engrave any non-metallic material, including rock, onyx, wood, glass and lucite.

"I wouldn't want to suggest that once you buy a laser, the rest is a cakewalk. Still it's obvious the laser in business is here to stay," Korbyl declares. "The only problem in our industry is the cost factor — but from our point of view it's been well worthwhile, particularly since we chose technology which allows us to do small runs economically."

Light Fantastic

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mated laser imaging and laser cutting systems. GSR president Dr. Erick Schmidt has declared enthusiastically on more than one occasion, "We have a chance in Alberta to be international leaders."

The same spirit is surfacing in other sectors as well. For example, Edmonton's Wavelength Sound, Light & Video Systems, is eyeing the possibility of local manufacture of laser light systems geared to the entertainment scene.

The firm, which handled the $500,000 installation of sound and light systems at West Edmonton Mall's Fantasyland Night Club, incorporated a new low-power laser system imported from the United States. Easier on the eyes than its more high-powered predecessors, the system is also much lower priced, opening the market to smaller clubs with limited budgets.

"Lasers in nightclubs represent a high growth market," says Terry McConaghy, director of marketing for Wavelength. "We've seen this technology used here for about the last six years. On frequent trips to Europe and the U.S. we see

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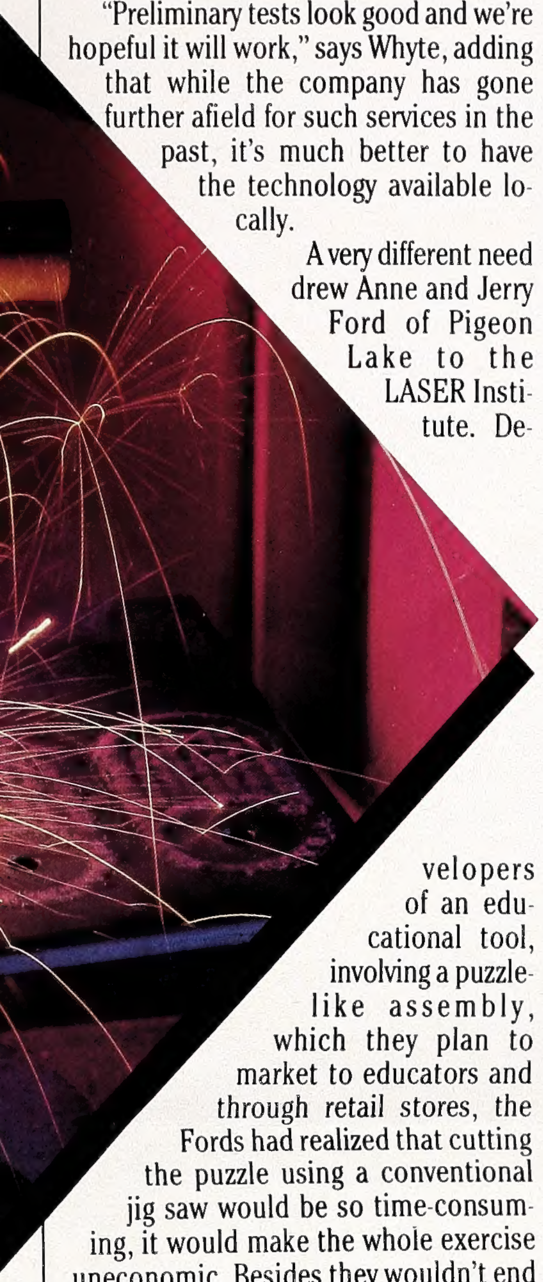


duce the component themselves from a tough ductile steel and have the Institute apply a layer of hard facing with a laser.

"Preliminary tests look good and we're hopeful it will work," says Whyte, adding that while the company has gone further afield for such services in the past, it's much better to have the technology available locally.

A very different need drew Anne and Jerry Ford of Pigeon Lake to the LASER Institute. Developers of an educational tool, involving a puzzle-like assembly, which they plan to market to educators and through retail stores, the Fords had realized that cutting the puzzle using a conventional jig saw would be so time-consuming, it would make the whole exercise uneconomic. Besides they wouldn't end up with the clean, detailed cut they were after.

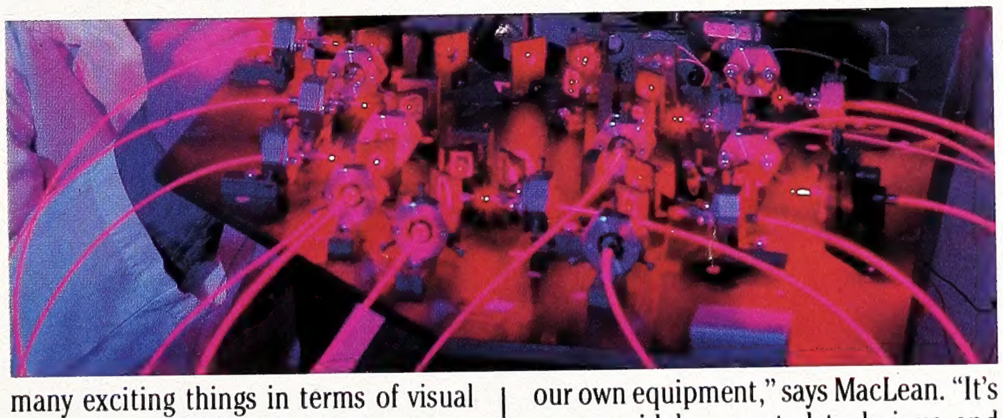
"When we went to the LASER Institute they showed us that with a laser cutter, the whole job could be done in six or seven minutes. It's certainly a very efficient way to manufacture something." Now beginning to pusue markets for their "Laser World" product, Anne Ford declares, "This is one product that I doubt could have been made at all without laser technology."

Witzke reveals that many more Alberta firms have approached the Institute with production problems. They include a heavy equipment dealer, valve manufacturer, toy manufacturer and graphics supply house.

Dale Allsopp, program director of the optics and robotics section, confirms he is working closely with a number of firms who plan to incorporate laser-based systems in their operations.

"We are at mid-program with a number of people and understandably there is a degree of sensitivity and trade secrecy involved. I can say, however, that I'm working on four very dramatic projects — two of which should be complete in eight months and two scheduled for completion in about 18 months."

Asked what he considers will be the net result of Alberta industry's growing commitment to laser technology, Allsopp replies, "It will mean a new dimension for Alberta industry, putting us in a league with major manufacturers in countries such as Japan, United States, England and Germany."



many exciting things in terms of visual effects produced with lasers." However, McConaghy adds, rather than importing the systems, "we'd like to see the manufacturing done here".

In another sector, Teknika Resource Development Ltd., a Calgary firm responsible for many innovations in petroleum exploration and development technology, has been experimenting with laser disks for storing large amounts of information.

At RCMP K Division headquarters in Edmonton, Corp. Bruce MacLean confirms the Identification Branch has been using an argon-ion laser since 1982 to illuminate fingerprints and help detect physical evidence such as hairs in fibres. "We started by using the assistance of Dr. Tulip at the University, then we got our own equipment," says MacLean. "It's now a widely accepted technique and it's proved very successful for us."

Throughout the province, toymakers, wood furniture manufacturers, developers of educational aids, oil and gas service companies, heavy equipment firms, telecommunications companies, printing houses, sign companies and engraving operations are among the dozens of firms which have either incorporated laser technology — or are exploring the possibilities.

According to the LASER Institutes's Rick Witzke, facility manager, Alberta's industrial and scientific communities are quickly learning that laser applications are virtually limitless. "Even the most traditional operations can benefit from the use of lasers."

GSR is a world leader in CO_2 industrial lasers

Convincing proof of Alberta's determination to maintain its early lead in the development and commercial use of laser technology is the presence in Edmonton of General Systems Research Inc. (GSR).

Best known for its strength in advanced lasercutting systems, the company supports a hefty research and development program which has seen it establish the largest continuous wave CO_2 laser laboratories in Canada. Here engineering and scientific staff specialize in areas of high reliability subsystems, high-speed beam switching, automated electromagnetic position, laser interactive surface chemistry, laser gas effluent scrubber systems and high resolution laser imaging processes.

Last fall the company unveiled an advanced computer-controlled laser-cutting system which paves the way for economic medium-volume industrial applications. The unit's relatively low cost (about one quarter that of earlier models) has been achieved in part by concentrating more of the manufacturing activity in Alberta. Instead of importing costly American lasers, the company is now making its own in its Edmonton manufacturing plant.

Designed to accommodate a second laser and thus double the throughput of earlier models, the units use high-power carbon dioxide laser beams to cut large sheets and rolls of textiles, plastics, woods, composites and other durable materials.

Dr. Erick Schmidt, GSR president and major player in Alberta's laser community, says the system represents the evolution of a wideranging GSR research and development program that has involved more than 100,000 hours of laser-cutting production experience at textile cutting centres throughout North America.

He notes the new GSR LC is capable of cutting speeds of more than 30 inches per second and features high-precision superior cut edge quality and automatic pattern design changes not possible with conventional production techniques.

At approximately $500,000 for the basic system, the technology is expected to quickly find its way into export markets in the apparel, automotive and industrial textile sectors.

GSR's aggressive pursuit of excellence in the field of industrial lasers has already won it the support of the provincial government, which last March purchased $15 million worth of shares in the company which GSR is to redeem over five years.

In announcing the move, Technology, Research and Telecommunications Minister Les Young noted that "GSR's leadership in the field of laser application, combined with the research and development capabilities of the University of Alberta and the Alberta LASER Institute, is developing the momentum to create increased job opportunities for Alberta."

A major international force in laser-cutting, GSR has seen its technology adopted in commercial production of premium interior fabric components for General Motors' Buick, Oldsmobile and Cadillac models.

General Systems Research: aggressive pursuit of excellence in the field of industrial lasers.

YAG lasers revolutionize surgery

A new endoscopic surgery technique, in which laser beams of varying wavelengths can be used to remotely cut, coagulate and stitch without cutting into a patient's body, has potential to dramatically cut costs of patient care while reducing patient trauma and disturbance.

Dr. John Tulip, professor and researcher in the University of Alberta's Faculty of Electrical Engineering, is the inspiration behind the MultiYAG machine. When the technology is fully exploited, he predicts, it could see 30,000 less women in Canada each year undergo hysterectomies. Use of endoscopic surgery, as opposed to traditional open surgery, would cut convalescence in such cases to days or weeks as compared to the roughly three months now required for recovery.

"Use of a laser within an optical endoscope device will allow the surgeon to literally peer into a patient's innards and flip back and forth between coagulating, cutting and welding procedures," Tulip explains.

Key to the new procedure lies in the development by Tulip and his team of a new YAG cutting wavelength which can be combined with existing YAG wavelengths capable of welding and coagulating, explains Jack Ondrack, president of Aurora Laser Inc., the company established to market the laser.

Carbon dioxide lasers, developed earlier for surgical cutting, do not lend themselves to use with fibre optics, he explains.

Dr. John Tulip: his MultiYAG laser reduces patient trauma.

With the latest development, Ondrack notes, "Aurora has a production prototype which works and we're now pursuing our first sales as well as financing." He adds U.S. consultants predict that by the early 1990s, the market for surgical lasers will have reached between $500 million and $1 billion.

"Any hospital with more than 100 beds could use two or three of these devices."

Meanwhile Tulip is seeking research funds to support clinical use of the technology. "I am working with a range of clinicians to develop new clinical procedures using this laser," he notes. "There's no doubt we're at the head of the pack worldwide on this."

In other research activity, Tulip has been collaborating since 1979 with Dr. Malcolm McPhee, director of surgery at Edmonton's Cross Cancer Institute, to explore the use of YAG laser therapy as an alternative form of treatment for bladder cancer. The YAG laser has also been used in treating selected lung, esophagus and colon cancer patients.

Pointing to the laser as one of medicine's many tools to combat illness and disease, McPhee has explained that medicine, electrical engineering and radiobiology are all being combined in the Institute's research effort.

Mark Arnfield, laser engineer at the Institute, notes that in the past four years the YAG laser has been used in the operating room about 120 times — "including repeat treatments on some patients".

Meanwhile, a second research laser at the Cross Cancer Institute — an argon-driven dye laser — will shortly be used to provide alternative treatment to some bladder and lung cancer patients.

"The argon dye laser produces a different effect than the YAG laser," Arnfield explains. "The YAG laser creates its effect by thermal action, either vaporizing or coagulating tissue. The dye laser works by photochemical effects, interacting with drugs present in the tissue."

Laser research at the Institute has been funded through a unique arrangement with Edmonton Oilers hockey star Glenn Anderson, prime ambassador for a major research funding initiative mounted by Acklands Limited, an automotive and industrial distributor. In 1985 the company agreed to contribute $1,000 for cancer research for every goal scored by Anderson. Gasland Oil Ltd. of Edmonton also became part of the arrangement, contributing an equal amount so that each Anderson goal funnelled $2,000 into the research fund.

The project was later expanded to include an "up-front" contribution of $80,000 by Acklands to support laser research for 1987 and 1988.

Among other projects involving medical lasers is work being undertaken by University of Alberta Hospital surgeons Dr. Jim Halvorson and Dr. John Huckell in conjunction with the Alberta LASER Institute. The team is experimenting with the use of lasers to remove loose cement which tends to break away from artificial hip and knee joints. The lack of force exerted by the laser is seen as a plus for this approach, since traditional chiselling procedures can cause bones to chip.

Furniture maker is first in Canada to use laser cutter

Tamrat Tekle is one Alberta entrepreneur who is not about to be discouraged by perceived limitations on the use of laser technology in the woodworking business.

The president of Edmonton's Tek Woodworks knew when he enlisted the support of the Alberta LASER Institute in cutting wood furniture components that "earlier attempts at cutting wood with lasers have not really been successful because of the burn marks created in the process. Laser processes for wood are generally limited to engraving applications."

Aware that in a sawmilling situation, such laser-induced burns would have to be removed by planing to create an acceptable product, Tekle reasoned this step really wasn't required for his own purposes — manufacturing a line of children's furniture.

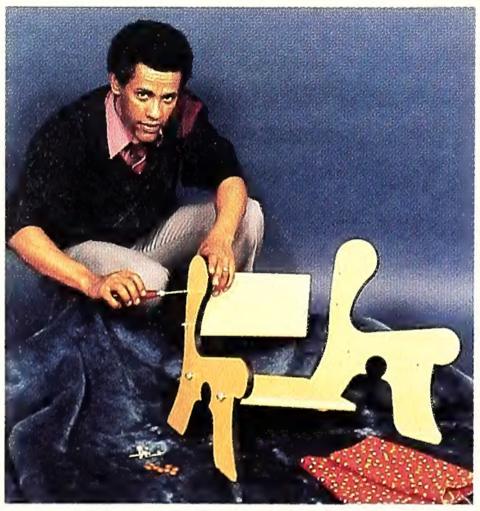
"I simply integrated the burn as a decorative element in the design of the furniture," says the wood scientist and former deputy head of Ethiopia's Wood Utilization and Resource Centre.

The result of this cooperative effort was an attractive and sturdy chair which was unveiled to favorable response during the official opening of the LASER Institute last year.

According to Tekle, it is the first prototype of a product line that will ultimately include miniature table and chair sets, a convertible six-in-one play and seating unit for children, as well as chairs incorporating an animal theme. He has also developed a flag holder which he hopes to target at the promotional gift market.

In describing his arrangement with the Institute, Tekle says, "I prepare the wood and finish the product and the Alberta LASER Institute handles all cutting."

While he expected to achieve both speed and quality of production with the laser, Tekle says another boon is the high utilization of raw material made possible through laser cutting.



Tamrat Tekle incorporates laser burns in design.

"Depending on your design you can utilize up to 90 per cent of raw material input. This compares with sawmilling where 60 per cent is considered extremely efficient," says Tekle, who has worked as a consultant for Alberta forest products companies.

"I see this as a potential breakthrough in manufacturing. When we go into production we expect to be the first such furniture plant using laser in Canada and possibly the world."

If the anticipated market for his products materializes, Tekle says he would plan to install his own laser equipment within two to three years. While the price tag could be as high as a half million dollars, he considers it fair exchange for the production efficiencies offered by laser cutting.